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ABSTRACT

This paper compares the methods for prescribing exercise according to various contemporary authorities. The programs are compared as to their goals, the testing modalities and physiological parameters used for prescription of the initial training session, and the methods and the progression of training. Regarding goals, there is a general agreement that aerobic capacity is the most important component. There is much variance with regard to the pretesting session, especially regarding the benefits of the exercise electrocardiogram and who should give the stress test. The widest discrepancies between authors are found in the criteria for prescription of the initial training session. Some authors recommend interval training, others continuous training, while others avoid any strict regimen for training. The question of both the optimal and the minimal number of days per week to elicit the training effect is still open to question. While some commonality was found among the authors sampled, it would appear that further research is warranted in the field of exercise prescription. (Author/JA)

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A COMPARISON BETWEEN PRESCRIBED EXERCISE PROGRAMS

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A paper presented at the AAHPER National Convention, Anaheim, April 1, 1974

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It is becoming increasingly accepted that exercise programs should be individually geared to obtain maximum benefits consistent with the lowest attrition rate possible. The recent surge in adult physical fitness programs throughout the United States has augmented this need for development of methods for prescribing exercise to each individual participating in an exercise program. At this moment there are relatively few methods of prescribing individualized exercise regimens. The purpose of this paper is to compare some of these methods as described by various authorities. An attempt will be made to show similarities where they exist and to discuss opposing opinions where they exist.

The programs have been compared as to their goals, the testing modalities used, the physiological parameters used for prescription of the initial training session and as to the methods and the progression of training. Each of these programs have been summarized in the paper you have before you.

As to the goals of an adult fitness program there was general agreement that of the components of physical fitness, aerobic capacity is the most important. Aerobic capacity, being a representation of the efficiency of the cardiovascular-cardiorespiratory systems, is an essential factor in one's hopes for a healthy life. Lack of exercise has been shown through research to be a factor in the etiology of coronary heart disease. With the improvement of one's aerobic capacity through exercise, one can hope to prevent or retard the onset of coronary heart disease. With regard to heart attacks, those who have a better aerobic capacity probably stand a better chance of surviving one due to the increased efficiency in the blood transport system of the heart. In addition to aerobic capacity, body composition, local muscle endurance, and flexibility were also recommended as goals of a good adult fitness program.

It was found that there was considerable variance between authors with regard to the pre-testing session. Of particular importance were the differences observed in the opinions expressed as to the benefits of the exercise electrocardiogram. The American Heart Association[6], Cooper[10], Cureton[13], Giese[17], Kasch and Boyer[20], Pollock[27], Wilmore[33], and Zohman[36] all agreed that a stress ECG should be required before participating in an exercise program. The American Medical Association[7,8,28] believes that persons over 40 should be required to have a stress ECG. Unless there is some evidence that there are symptoms or history of heart disorders, those people under 40 would not be required to have one. The R.C.A.F. [29], Golding and Bos[18], the Y.M.C.A. at Brockton, Mass.[34] and Graham[19] programs do not require participants to have a stress ECG.

While Astrand[2] believes that much can be learned about a person's capabilities by performing a stress ECG, he does not indicate the importance of an ECG requirement prior to participation in an exercise program. He contends that, "you should have to pass a physical examination to be allowed to remain inactive. The man who can not pass a physical examination is the one who needs the exercise. My feeling is that exercise is less dangerous than inactivity."[2:164]. Taking a more conservative stand, Zohman stated that "a resting ECG is not enough. We need a dynamic evaluation, a 'road test'..."[36:113]. Cooper in agreement with this

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philosophy stated, "I am becoming emphatic on the importance of treadmill testing with the multi-lead monitering because this is the way to implement a safe program"[10:143]. In his article "Guidelines in the Management of the Exercising Patient"[9] Cooper gives other important considerations concerning the screening of people wishing to participate in exercise programs. He lists a number of absolute contraindications to exercise such as recent myocardial infarction, pulmonary embolism, marked obesity and uncontrolled hypertension as well as other relative contraindications which include general medical conditions such as diabetes requiring insulin therapy, and hepatic disease. Also listed are less serious respiratory problems, musculoskeletal problems, cardiovascular and neurological conditions.

Another issue of controversy has been that of the role of the physician in the organization and administration of an exercise program. Dr. John Faulkner in his article, "Screening for and supervision of graded exercise tests"[16] asserted that participants under 30 years of age and with minimal or no risk factors may have a stress ECG administered to him without a physician being present. However, if the participant "is symptomatic with either suspected or documented coronary artery disease"[16:7] a physician must be in visual contact. If the participant is over 30 but is asymptomatic "a physician must be in the test area"[16:7]. In a "counterpoint" to Faulkner's opinions Dr. Gordon Cumming[12] wrote that he believed that properly trained technicians, nurses, physiotherapists, and physical educators should be allowed to administer stress tests without direct supervision. He believes that "high quality detailed instructional courses with certification should be provided"[12:7]. He adds that there are "not enough physicians currently capable"[12:6] to administer and assess the stress tests. I am sure that the controversy here will be a major one now that there has been a great increase in the number of stress tests administered by non-physicians. With the inevitable fact of deaths occurring for one reason or another at the time of, or shortly afterward, a stress test is administered, the legal implications surrounding this issue will be severely tested.

Various methods of determining the initial workout session were implemented by the authorities. Stress testing of one type or another was used by most authors but a few programs did not "individualize" their regimens and started all participants at a selected "beginners level." A physical examination and some type of submaximal stress tests are recommended by all programs with the exception of the R.C.A.F. 5BX program[29] which assumes nothing and starts everyone at the lowest level. Not all the programs require the stress ECG. The reason for this may be because of availability, administrative feasibility or the belief that it is not important when considering taking part in an exercise program. (See Table 1)

There are differing opinions as to the type of training to be implemented during the training session. A controversy exists as to whether to use interval training or a continuous "steady state" type of regimen. Astrand[2] recommends that the most "fool proof way to load the oxygen transport system is the interval time..." Graham[19] states that a task "with uniformity" such as jogging in one place should be the initial phase of an exercise program. Of the exercise programs

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sampled Astrand[2], Golding and Box[18], Kasch and Boyer[20], and Pollock[27] recommended interval training as the best type of training.

The other authorities recommended that a continuous type of exercise be implemented. Most authors agreed that there should be a warm-up period, a stimulus period, and a cool-down period comprising each session although the respective time allotments for each period were considerably different in some cases. Zohman[36] believes that a 10-20 min. warm-up, a 10-20 min. stimulus period, and a cool-down period in which the heart rate returns to its resting rate is necessary. In comparison, the R.C.A.F. 5BX program[29] contends that a warm-up period is not necessary because of the type of exercises used and the way in which they are arranged have the warm-up "built in." It should also be noted that the 5BX is only 11 min. in duration and there is no cool-down period. With this exception however, all programs recommend a warm-up period to get the heart rate to a "training stimulus" with a tapering-off period at the end of each session. Cooper[10] recommends that the cool-down period last at least 10 min. at the temperature and the humidity at which the exercise was performed. This suggests the danger of the non-trained individual using a sauna immediately after exercise. The stimulus period ranged from a minimum of 5 min. to 30 min.--which displays a great difference of opinion between the authors. (See Table 2)

In regard to the intensity, duration, and frequency of exercise, there was general agreement that exercise should be done at least 3-5 days per week. In support of this recommendation, Pollock[26] found that differences were noted between groups exercising 2 or 4 days per week for 20 weeks. The 4-day per week group improved significantly more than did the 2-day per week group. As to intensity, Sharkey[30] found no significant differences between three groups training at heart rates of 130, 150 or 170 beats/min. and working at two levels of duration. Shephard[31] however, found that "the main factor influencing the extent of training achieved was the intensity of effort relative to the subject's initial aerobic power"[31:272]. He feels that the lower the initial aerobic power, the more important the intensity. Burke and Franks[5] compared young men working at 65, 75, or 85% of the max. $\dot{V}O_2$ holding total mechanical work constant between intensities and found that only those individuals working at 75 and 85% of their maximum would significantly increase their max. $\dot{V}O_2$.

In regard to the recommended level of stimulus for training, there is considerable variance between the authors ranging from 85% of max. H.R. according to Pollock[27] and Zohman[36], to 120 beats/min. according to the Y.M.C.A.[34]. While some authors recommended a starting point determined from the pre-testing session, others start everyone off at the lowest level of activity as do Cureton[13,14], R.C.A.F. 5BX[29], and the Y.M.C.A.[34].

Summary

The literature seems to be uniform in the recommendations made as to the goals of a good adult fitness program. Similarities exist in the need for a pre-exercise medical examination, and a warm-up, stimulus, and cool-down period in each training session.

While there was some commonality found among the authors sampled, it would appear that further research is warranted in the field of exercise prescription with special consideration given to the areas of stress testing with the ECG (that is, should one be given and who should perform it and/or assess it), the optimal intensity of exercise for each individual, and the duration of the activity session with regard to the time alloted to the warm-up, stimulus, and cool-down periods.

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Table 1

CRITERIA AND TESTING MODALITY
USED FOR PRESCRIPTION

Authority	Criteria and Testing Modality
American Heart Association (6)	1. Risk factors and control of them. Stress ECG
American Medical Association(7,8,28)	1. ECG Before and after mild sustained exercise for persons over 40. 2. Harvard Step Test.
Per-Olof Astrand (2,3)	1. Submaximal Bicycle Ergometer Test.
Kenneth Cooper (9,10,11)	1. Treadmill Test (with ECG). 2. 12-Min. Run. 3. Bicycle Ergometer Test (not recommended)
Thomas Cureton (13-14)	1. Treadmill Test (Cureton's) (with ECG)
Warren Giese (17)	1. Stress testing with ECG.
Lawrence Golding and Ronald Bos (18)	1. One-min. Step Test (for adults) 2. Two-min. Step Test (for college-aged men) 3. Two Mile Run for Time.
M. F. Graham (19)	1. Minimum Exercise Response Test (using the Five Point Rule).
Fred Kasch and John Boyer (20)	1. Step Test: Kasch Pulse Recovery Test. 2. Max. VO_2 on Treadmill, Bicycle Ergometer, or Bench (with ECG)
Michael Pollock (27)	1. Treadmill Test (with ECG) 2. Double Master's Two-Step 3. Progressive Pulse Ratio Test. 4. GXT 5. Kasch All-out Step Test.
R.C.A.F. (5BX) (29)	1. No test given.
Jack Wilmore (32,33)	1. Treadmill Test (with ECG)
Y.M.C.A. at Brockton, Mass. (34)	1. Must go through a "testing clinic."
Lenore Zohman (36)	1. Treadmill, Bicycle Ergometer, or Step Test (with ECG)

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Table 2

RECOMMENDED STIMULUS LEVEL FOR INITIAL WORKOUT SESSION

Authority	Stimulus
American Heart Association (6) American Medical Association (7,8,28)	Below 75% predicted max. H.R. or 65-75% max. $\dot{V}O_2$ score on Harvard Step Test: Below 55: walking, light calisthenics 55-75: calisthenics, games, swimming, moderate running, and cycling Above 75: all of the above plus, (if desired) sprints, cross-country running, and other strenuous exercise.
Per-Olaf Astrand (2,3)	Do enough to bring H.R. to produce a training effect. 70% max. $\dot{V}O_2$ may be too much.
Kenneth Cooper (10,11)	Scores from stress test related to the age-adjusted "Aerobics Chart Pack" (great diversity in stimulus level).
Thomas Cureton (13,14)	Start at LOW GEAR work with 3-6 months of gradual progression.
Warren Giese (17)	Start at no more than 140 beats/minute.
Lawrence Golding and Ronald Bos (18)	60% of difference between resting and maximum H.R. (predicted) 130 beats/minute is minimum.
M.F. Graham (19)	Minimum Exercise Response (MER) Test using the Five Point Rule: Peak pulse rate must exceed 140 beats/minute.
Fred Kasch and John Boyer (20)	Use of Karvonen Formula or H.R. stays below 144 beats/minute for the first three months.
Michael Pollock (27)	For unhealthy men: H.R. not to exceed 150 beats/minute for men under 50; 140 beats/minute if over 50. For healthy men: 75-85% of max. H.R.
R.C.A.F. (29)	Start at bottom of Chart 1.
Jack Wilmore (32,33)	Must attain 60-80% max. H.R. (75% recommended) for at least 30 minutes each session (in order to earn the MET points of that particular exercise).
Y.M.C.A. at Brockton, Mass. (34)	Pulse rate must be maintained between 120-150 beats/minute; 160 beats/minute is maximum.
Lenore Zohman (36)	85% max. H.R. if stress ECG is normal 70% max. H.R. if stress ECG is not normal or 60-80% max. $\dot{V}O_2$ and blood pressure does not exceed 250mm. Hg. systolic.

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1. Astrand, Irma, and others. "Intermittent muscular work," Acta Physiologie Scandanavia, 48:448-453, 1960.

2. Astrand, Per-Olof. "Do we need physical conditioning," Journal of Physical Education, March-April, 1972, pp. 129-136.

3. Astrand, Per-Olof. Health and Fitness. Skandia Insurance Company, Universal-tryck, Stockholm, 1972.

4. Berger, R.A. Physical Conditioning For Man. Boston: Allyn and Bacon, Inc., 1973.

5. Burke, Edmund J., and B. Don Franks. "Changes in VO_2 Max, Resulting from Bicycle Training at Different Intensities Holding Mechanical Work Constant." Paper read at the AAHPER National Convention, April, 1973, Minn., Minn.

6. Committee on Exercise. Exercise Testing and Training of Apparently Healthy Individuals: A Handbook for Physicians. New York: American Heart Association, 1972.

7. Committee on Exercise and Physical Fitness of the American Medical Association. "Is your patient fit?" J.A.M.A., 201:117-118, 1967.

8. _____, and the President's Council on Physical Fitness. "Evaluation for exercise participation," J.A.M.A., 219:200-201, 1972.

9. Cooper, Kenneth H. "Guidelines in the Management of the exercising patient," J.A.M.A., 211:1663-1667, 1970.

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11. _____. The New Aerobics. New York: Bantam Books, 1970.

12. Cumming, Gordon R. "Supervision of exercise tests," A.C.S.M. News, 8:6-8, October, 1973.

13. Cureton, Thomas K. "Physical fitness and dynamic health," Journal of Physical Education, March-April, 1972, pp. 117-125.

14. _____. Physical Fitness Workbook for Adults. Champaign, Illinois: Stipes Publishing Co., 1970.

15. _____. The Physiological Effects of Exercise Programs on Adults. Springfield, Illinois: Charles C. Thomas, 1969.

16. Faulkner, John A. "Screening for and supervision of graded exercise tests," A.J.S.M. News, 8:6-8, April, 1973.

17. Giese, Warren K. "A reasonable approach to physical activity," Journal of Physical Education, March-April, 1972, pp. 145-147.

18. Golding, Lawrence A., and Ronald R. Bos. Scientific Foundations of Physical Fitness Programs. Minneapolis: Burgess Publishing Co., 1970.

19. Graham, M.F. Prescription for Life. New York: Van Rees Press, 1966.

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20. Kasch, Fred W., and John L. Boyer. Adult Fitness Principles and Practices. Palo Alto, California: National Press Books, 1968.

21. Larsen, V.A. and Malmborg, R. O. Coronary Heart Disease and Physical Fitness. Baltimore, Md.: University Park Press, 1971.

22. Lersten, K.D. Physiology and Physical Conditioning Theory to Practice. Palo Alto, California: Peek Publications, 1971.

23. Maness, William. Exercise Your Heart. London: Collier-Macmillan Ltd., 1969.

24. Morse, R. L. Physicians Handbook for Evaluation of Cardiovascular and Physical Fitness. Tennessee Heart Association, Physical Exercise Committee, 1971.

25. _____. Exercise and the Heart. Springfield Illinois: Charles C. Thomas Publisher, 1972.

26. Pollock, Michael L., Thomas K. Cureton, and Leonard Greninger. "Effects of frequency of training on working capacity, cardiovascular function, and body composition of adult men," Medicine and Science in Sports, 2:197-202, 1970.

27. _____, Richard Janeway, and Henry Miller Jr. "Endurance training for middle-aged men," North Carolina Medical Journal. June, 1970, pp. 212-218.

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29. Royal Canadian Air Force. Exercise Plans for Physical Fitness. Revised Ed. Simon and Schuster Inc., 1962.

30. Sharkey, Brian J. "Intensity and duration of training and the development of cardiorespiratory endurance," Medicine and Science in Sports, 2:197-202, 1970.

31. Shepard, Roy L. "Intensity, duration and frequency of exercise as determinants of the response to a training regime," Internationale Zeitschrfit fur Angewandte Physiologie, 26:272-278, Sept., 1968.

32. Wilmore, J.H. (ed.). Exercise and Sport Science Review. Vol. 1, New York: Academic Press, 1973.

33. _____. "Exercise Prescription," Adult Fitness Program, University of California, Davis, California. (Mimeographed.)

34. Y.M.C.A. at Brockton, Mass. "A Leader's Guide to Weekly Progressions." (Mimeographed.)

35. Philip K. Wilson. "Cardiac Rehabilitation Programs," JOHPER, 45:47-54, 1974.

36. Zohman, Lenore R. "Exercise by prescription," Journal of Physical Education, March-April, 1972, pp. 113-116.

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1. American Medical Association and The President's Council on Physical Fitness and Sports. "Physical Fitness in Business and Industry," North American Rockwell Corporation and Phillips Petroleum Company, 1973.

Author: American Medical Association (from Physical Fitness in Business and Industry) in conjunction with President's Council on Physical Fitness and Sports.

Testing Modalities: Medical history plus a physical examination at rest and after exercise. Electrocardiogram for persons over 40, before and after mild sustained exercise.
Harvard Step Test.

Basis for Prescription: If score below [illegible] on Step Test - walking and mild calisthenics.
If 55-75 - regular calisthenics, games, swimming, cycling, and moderate running.
If above 75 - all of the above plus (if you want) add wind sprints, cross country running and other strenuous exercise.

Progression: Score 55 or below: start at walking 1 mile in 20 min. gradually increasing the distance to 2 miles in the same time.
Score 55-75: try jogging a mile in 10 or 11 min. - if too hard intersperse with walking. 3 miles in 30 min. is ideal.
All walking should be at a speed to cover one mile in 20 min. The distance is then increased to 3 miles in 1 hour. At this point the pace is increased to 3 miles in 45 min., after this the person can begin jogging.
*the individual should set his own pace - competition could be harmful to the non-conditioned person.

2. Astrand, Per-Olof, "Do We Need Physical Conditioning?" Journal of Physical Education, March-April, 1972, pp. 129-135.

Author: Per-Olof Astrand

Testing Modalities: Bicycle ergometer or max HR = 220-age
(for prediction of O_2 uptake)

Basis of Prescription: Do enough to bring H.R. to produce a training effect - 70% of max O_2 uptake may be too much.
Recommends interval training - although anything severe enough will suffice

Progression: Do not overstress or fatigue yourself. Progress slowly. Never run against a watch.

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3. Cooper, Kenneth H., The New Aerobics. New York: Bantam Books, 1970.

Author: Kenneth Cooper

Testing Modalities: Treadmill, 12-minute Run, Bicycle Ergometer (not recommended)

Basis of Prescription: Based on the distance covered in the 12-minute run, or the max $\dot{V}O_2$ on the treadmill: the subject is placed in one of the age-adjusted programs in the Aerobics Chart Pack. The programs are categorized:

I. Very Poor	6 week starter program
II. Poor	10 week conditioning program
III. Fair	
IV. Good	
V. Excellent	

Progression: Progress according to the program, through each fitness category until a 30 point plus program is reached (30 points or more per week is the set goal) points being based on the amount of O_2 needed to perform a given activity in a given amount of time.

4. Cureton, Thomas K. "Physical Fitness and Dynamic Health," Journal of Physical Education, March-April, 1972, pp. 117-125.

Author: Thomas K. Cureton

Testing Modalities: 1 minute run 180 steps/min.
Treadmill, heartometer with the ECG, ECG in exercise and Pre-ejection intervals.

Basis of Prescription: Start of a LOW GEAR work with 3-6 months of gradual progression.

Progression: Gradual progression through each one of 3 stages
LOW GEAR (200-300 Cal/Hr.)
MIDDLE GEAR (400-500 Cal/Hr.)
HIGH GEAR (600-up Cal/Hr.)

5. Giese, Warren K. "A Reasonable Approach to Physical Activity" Journal of Physical Education, March-April, 1972, pp. 145-147.

Author: Giese, Warren K.

Testing Modalities: Stress and maximun testing (probably on treadmill)

Base of Prescription: Starter program should be limited to no more than 140 beats/min. which is moderate physical activity.

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Progression: Starter Program: walking and/or low-level activities 4-5 days/week; progress in intensity increasing over a 6 to 12 week period. If heart rate exceeds 140 during this period - see a doctor.

5-10 min. warm-up
15-20 min. work period
5-10 min. cool down
Progress to programs of higher intensity
H.R. 100-120 - light activity
H.R. 120-140 - moderate activity
H.R. 140 and up - vigorous activity

6. Golding, Lawrence A., and Ronald R. Bos. Scientific Foundation of Physical Fitness Programs. Minneapolis: Burgess Publishing Company, 1970.

Author: Lawrence A. Golding and Ronald R. Bos

Testing Modalities: One-minute Step Test (for adults) or
Two-minute Step Test (for college man)
or
Two Mile Run for Time

Basis of Prescription: 60% of the difference between resting and maximum heart rate (130 beats/min. is minimum)

Progression: Progressive interval training program including walking, jogging, running and 3 to 4 different calisthenics. A minimum of 3 times per week for a minimum of 30 mirutes.

Golding, Lawrence A., "Scientific Foundations of Physical Fitness Programs." Burgess Publishing Co., Minneapolis, 1971.

7. Kasch, Fred W., and John L. Boyer. Adult Fitness, Palo Alto, California: National Press Books, 1968.

Author: Fred W. Kasch and John L. Boyer

Testing Modalities: The Step Test: Kasch Pulse Recovery Test. Also:
Blood Pressure (cuff and stethoscope), Anthropometric Measurements, Posture, Performance (flexibility, strength and endurance).
Max VO_2 on treadmill, bicycle ergometer, or step - (Douglas Bag Method)

Basis of Prescription: Usage of the Karvonen formula or heart rate stays below 144 for the first 3 mos.; 150 3rd to 6th after 6 months, 70% of working heart rate is used.
70% max VO_2 is considered optimum but depending on true max VO_2 in some cases only 40 or 50% is used and some may go as high as 90%.

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Progression: 3 Stage Program (I-III)
Stage I (5'-10' Program) - first 3 months: Beginning Fitness
Stage II (30'-30' Program) - 4th & 5th months: Intermediate Fitness
After 3 months all persons should have a heart rate below 130 after one-minute recovery on the Kasch Pulse Recovery Test.
If heart rate falls below 150 during exercise, the pace should be quickened.

To move to Stage III

1. Kasche Pulse Recovery Test. H.R. below 120 First Recovery min.
2. Run 5 min. continuously
3. Heart Rate 2 min. after the 5-min. run, 120 or below

Stage III (30'-30' Program) - 6th month and thereafter: Advanced Fitness - Progressive exercises (calisthenics) and interval training.

8. Pollack, Michael L., Richard Janeway, and Henry Miller, Jr. "Endurance Training for Middle-aged Men," North Carolina Medical Journal, June, 1970, pp. 213-218.

Authors: Michael L. Pollack, Richard Janeway and Henry Miller, Jr.

Testing Modalities: Treadmill Test on: Double Master's Two-Step; Progressive Pulse Ratio Test, the graded exercise test (GXT), five minute step, Kasches All-out Step Test.
Also a profile of physique: girth, body weight and composition measures; a motor efficiency appraisal (strength, endurance, flexibility); serum lipid determinations; blood glucose; and spirometry.

Basis of Prescription: Heart rate not to exceed 150 beats/min. for men under 50, 140/min. for men over 50 (for unhealthy men). For healthy men, 70-85% of maximum.

Progression: Start at 150-200 Kcal expenditure (low gear starter programs: Cooper's Categories I and II or Cureton's low gear training regimen), training every other day which includes 10 min. light calisthenics, 15-20 min. of walking and jogging.
After 3-4 months - train 4 or 5 days per week at 300 Kcal/session.

9. Wilmore, Jack. Paper on Exercise Prescription. Adult Fitness Program, University of California, Davis, California.

Author: Jack Wilmore

Testing Modalities: Endurance capacity by TREADMILL TEST

Basis of Prescription: 4 factors
I. Type of Exercise - Suggested like, running, walking, jogging, sw
II. Frequency of exercise - 3-4 times/week
III. Duration of exercise - 15-30 min. (exclude warm-up)
IV. Intensity of exercise - depending on Treadmill Test

A. attain 60-80% of capacity (75% by Wilmore)
1) (THR-Training heart rate) - determined by taking pulse every 5 min. of a 30 min. exercise.

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Program based on the MET (equals 3.5 ml. of O_2/Kg. body wt./min.; O_2 consumption at rest).

Must work 10 min. to obtain the MET value of any one particular exercise. Striving for the "optimal conditioning levels for men of various ages. (Table 1).

Progression: 4 Programs (A-D)
6 Steps (I-VI)

Must stay at each step a minimum of 2 weeks (usually 3). Progress from one step to next and move from program to program in succession- at 3-week/step = 90 weeks for completion of program.

10. Y.M.C.A., Brockton, Mass. "A Leaders' Guide to Weekly Progressions

Author: Brockton, Mass. Y.M.C.A. Physical Fitness Department adopted by the Southern Tier Heart Association of New York State.

Testing Modalities: Heart rate after:
Peak run (trying for a 9 min. mile), step-ups, sitting tucks, or pushups.
Must come through Testing Clinic first.

Basis of Prescription: Pulse must be maintained between 120-150 beats/min. with 160/min. as maximum.

Progression: Progressive: [illegible], jogging, running, program completed in 32 weeks. (Interval training).

11. Zohman, Lenore R. "Exercise by Prescription," Journal of Physical Education, March-April 1972, pp. 113-116.

Author: Lenore Zohman

Testing Modalities: Bench (step), bicycle ergometer, treadmill

Basis of Prescription: Max $\dot{V}O_2$, blood pressure, H.R. are taken
Work at 85% of max. H.R. if ECG is normal; if not,
" " 70% " " " " " " " , and so on.
60-30% of max $\dot{V}O_2$
B.P. not above 250mmHg systolic

Progression: Proceed at lowest levels of training
The training heart rate is the target H.R.
Expect improvement from 6 mos. to 1 yr.

10-20 min. warm-up resting H.R. to training heart rate
10-20 min. stimulus training H.R. - steady state
cool down per training H.R. - resting H.R.

In cardiac patients, warm-up and cool down periods may be abbreviated because of lessened endurance - but need to keep that training H.R. for at least 15-20 min.

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12. Graham, M. F. Prescription for Life, Van Rees Press, New York, 1966.

Author: M. F. Graham, M.D.

Testing Modalities: Complete medical examination if sedentary or if over 35 years old. Minimum Exercise Response Test (2 or 4 steps/min.) using the Five Point Rule.

Basis for Prescription: Running in place for two minutes is recommended at the beginning. Peak pulse rate is to exceed 140 beats/min. Done every other day or at least three times per week.

Progression: When comfortably able to do so, increase duration of exercise 1 min. or so until running for 10 min. at 2 steps/sec. Then increase step-rate.
Progression then proceeds to outdoor activities. (non-competitive to competitive). Goal is to use 400-450 Kcals. in 30 minutes.

13. Royal Canadian Air Force. Exercise Plans for Physical Fitness, Revised Ed., Simon and Schuster Inc., 1962.

Author: Royal Canadian Air Force

Testing Modalities: none for the 5BX Program

Basis for Prescription: none--everyone starts at the same level

Progression: Start at bottom level and work up gradually to the recommended goal for your age level. Must be able to do A+ level in 11 minutes before proceeding to the next chart.
Speed of progression depends on age. (e.g. 45 year old must spend at least 7 days at each level) Should be done every day.

14. The Committee on Exercise. Exercise Testing and Training of Apparently Healthy Individuals: A Handbook for Physicians, New York: American Heart Association, 1972.

Author: The Committee on Exercise of the American Heart Association

Testing Modalities: Complete medical history, risk factors and control of them, Stress ECG (before exercise continuing until after cessation)

Basis for Prescription: Below 75% of predicted max. H.R. or 10-20 beats below that reached in the submaximal test or 65-75% of predicted max. $\dot{V}O_2$.

Progression: Session is 15-20 min. long, 3 times/week (daily preferred), 5 min. warm-up and cool down periods.
NO highly competitive activities.
Sessions have gradual increase in exertion over days or weeks.